Magnetic fields in large-scale structures

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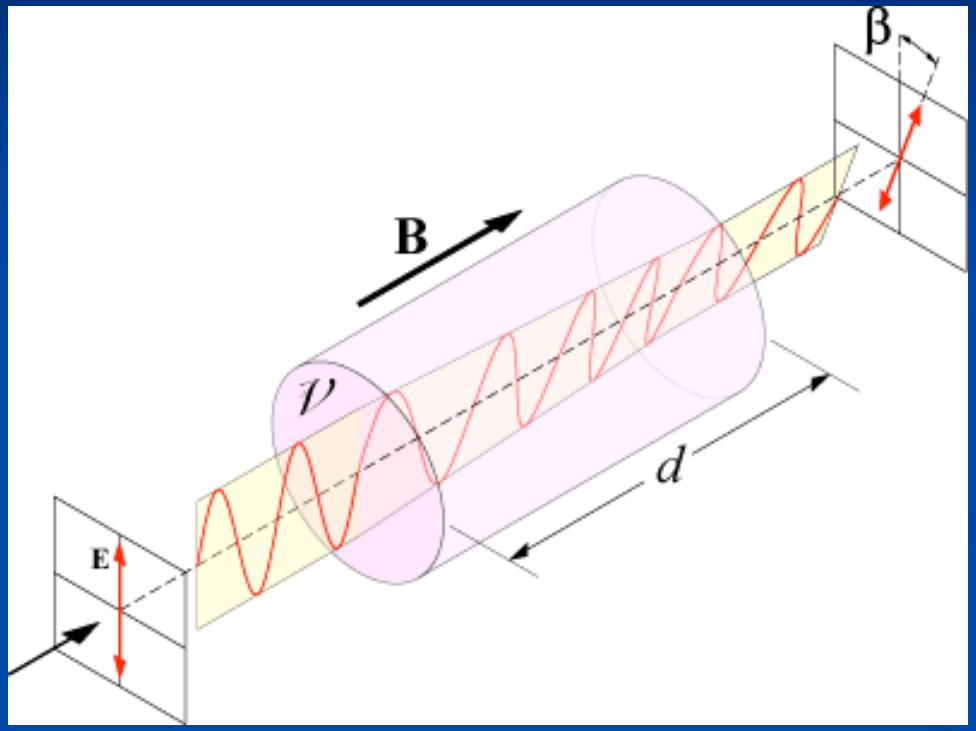
How to Measure the B-field?

- Synchrotron emission
- Zeeman Effect
- Faraday Rotation measure (RM)

What is RM?

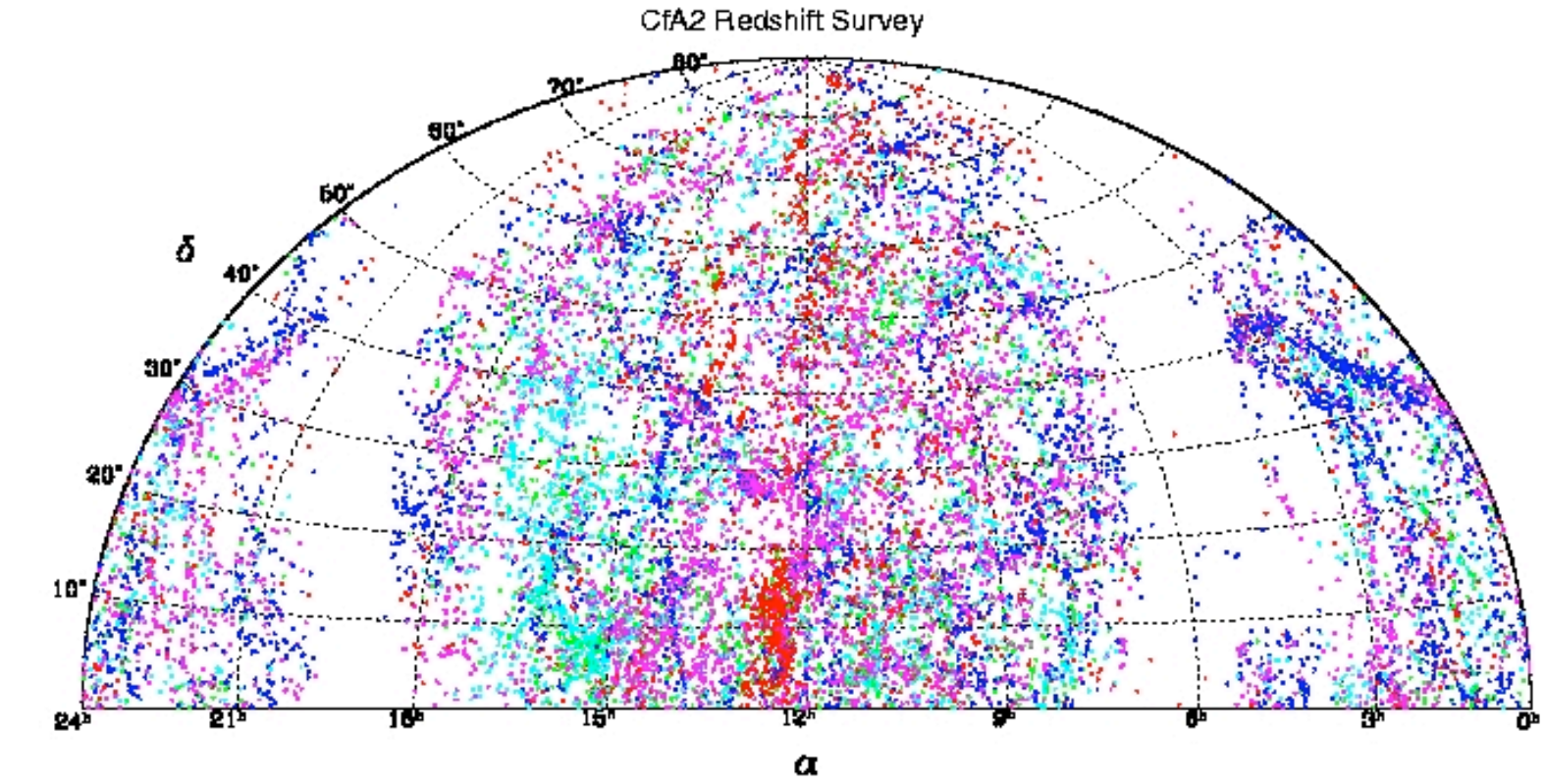


- RM = 0.81 n_e B d [rad m^{-2}]
- Statistically, we expect a larger RM variation after radio signal passing through large-scale structures

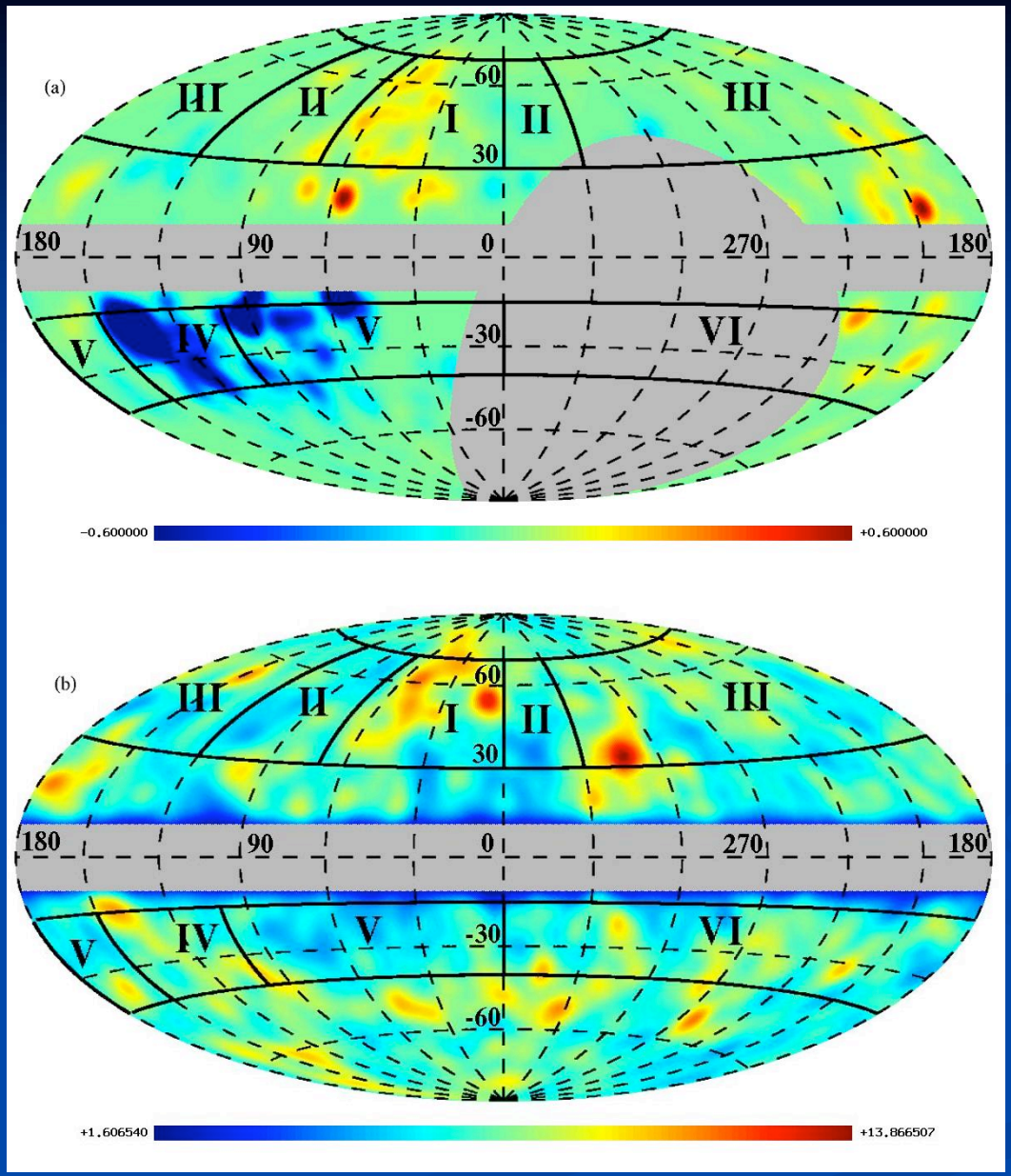
Major Contaminations in RM

- RM caused by the B-field of the radio sources
  - Can be minimized by averaging RMs over a certain area of sky
- RM caused by the B-field in the Milky Way
  - RM is dependent on the galactic latitude (Simard-Normandin and Kronberg, 1980, ApJ)

Data



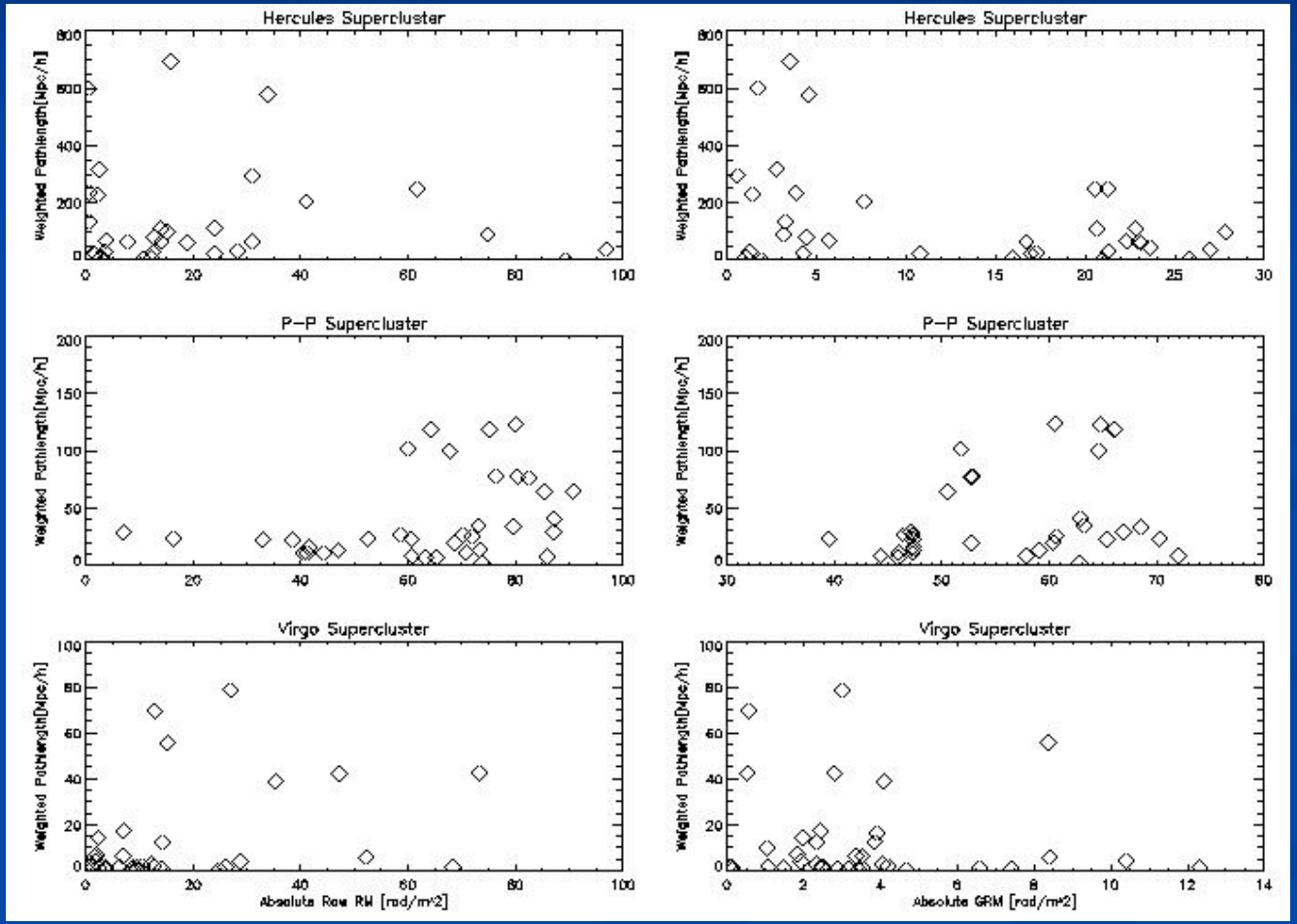
Data


(a)
III
II
I
II
III
60
30
180
90
0
270
180
V
IV
V
-30
VI
-60
−0.600000
+0.600000
(b)
III
II
I
II
III
60
30
180
90
0
270
180
V
IV
V
-30
VI
-60
+1.606540
+13.866507

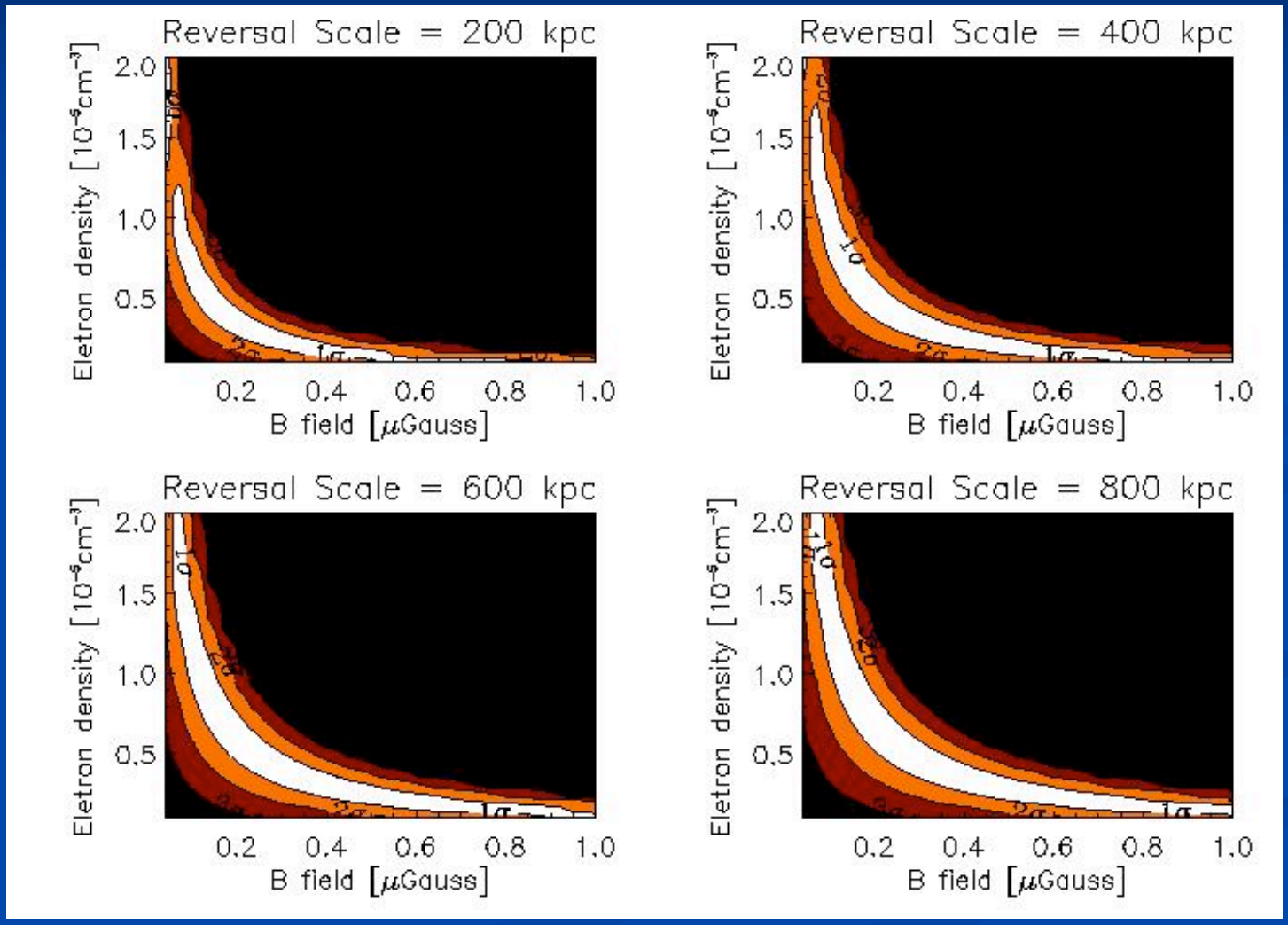
Comparison of RMs in High and Low Density Areas

Sky areas	Ave. SRM	Ave. RRM
I (50)	14.3	16.2
II (30)	10.0	14.4
IV (45)	56.8	78.8
V (42)	41.0	67.2

Correlations between RMs and Weighted Pathlengths



Constraints on B-field



Conclusions

- The enhanced RMs give clues of the existence of magnetic field in Hercules and P-P superclusters
- Comparing with the simple model, we constrained the B-field of order 0.3 uG in Hercules Supercluster.
- We found that RM shows positive correlation with pathlength.